

REMARKS

This is intended as a full and complete response to the Office Action dated July 28, 2005, having a shortened statutory period for response set to expire on October 28, 2005. Please reconsider the claims pending in the application for reasons discussed below.

Claims 1-5, 9-14, 16-20, 24-30 and 34-45 remain pending in the application upon entry of this response. Claims 1-5, 9-14, 16-20, 24-30 and 34-37 stand rejected by the Examiner. Claims 38-45 have been added by the Applicant. Reconsideration of the rejected claims is requested for reasons presented below.

The Examiner asserts that the title of the invention is not descriptive and requires a new title to clearly indicate the claimed invention. The Applicant has changed the title of the invention to "Process for Forming a Dilute Sulfuric Peroxide Solution at the Point-of-Use" for more clearly indicating the claimed invention.

Claims 1-2, 5, 9-12, 14, 16, 20, 24-27, 29-30, 34-35 and 37 stand rejected under 35 USC § 102(b) as being anticipated by Ramachandran et al., WO-02/10480, (herein "*Ramachandran*"). The Examiner asserts that *Ramachandran* discloses claimed aspects of the invention. The Applicant respectfully traverses the rejection.

Ramachandran describes a process to form and use an etching solution containing sulfuric acid, hydrogen peroxide or ozone and a fluoride containing compound. *Ramachandran* forms the etching solution by combining a mixture of water, sulfuric acid and hydrogen peroxide with another mixture having the fluoride containing compound. (Abstract, steps "a" and "b"; and page 9, paragraph 3).

Therefore, *Ramachandran* does not teach, show or suggest a method for removing a residue from a substrate surface, comprising mixing an aqueous solution comprising sulfuric acid and hydrofluoric acid with a hydrogen peroxide solution to produce a cleaning solution, wherein the cleaning solution comprises hydrogen peroxide at a concentration within a range from about 1% to about 15% by weight, sulfuric acid at a concentration within a range from about 1% to about 10% by weight and hydrogen fluoride at a concentration within a range from about 10 ppm to about 1,000 ppm, applying an aliquot of the cleaning solution to a substrate surface for a time

period and rinsing the aliquot from the substrate surface with water to form a wash solution, as recited in claim 1 and claims dependent thereon.

Also, *Ramanchandran* does not teach, show or suggest a method for cleaning a residue from a substrate surface, comprising combining an aqueous solution and a hydrogen peroxide solution at a predetermined weight ratio of about 1 to about 20 to form a cleaning solution, exposing the substrate surface to an aliquot of the cleaning solution, wherein the cleaning solution comprises hydrogen peroxide at a concentration within a range from about 1% to about 15% by weight, sulfuric acid at a concentration within a range from about 1% to about 10% by weight, and hydrogen fluoride at a concentration within a range from about 10 ppm to about 1,000 ppm, and rinsing the substrate surface with water to remove a residue and the aliquot of the cleaning solution, as recited in claim 14 and claims dependent thereon.

Also, *Ramanchandran* does not teach, show or suggest a method for mixing and delivering a cleaning solution to remove a residue from a substrate surface, comprising providing an aqueous solution comprising sulfuric acid and hydrofluoric acid, combining the aqueous solution and a hydrogen peroxide solution to form the cleaning solution, wherein the cleaning solution comprises hydrogen peroxide at a concentration within a range from about 1% to about 15% by weight, sulfuric acid at a concentration within a range from about 1% to about 10% by weight, hydrogen fluoride at a concentration within a range from about 10 ppm to about 1,000 ppm, and a surfactant at a concentration of about 1,000 ppm or less, delivering the cleaning solution to a substrate surface, removing at least a portion of a residue from the substrate surface, and rinsing the substrate surface to remove the cleaning solution, as recited in claim 29 and claims dependent thereon.

Withdrawal of the rejection is respectfully requested.

Claims 1-2, 5, 9-12, 14, 16, 20, 24-27, 29-30, 34-35 and 37 stand rejected under 35 USC § 102(e) as being anticipated by Rath et al., US 6,630,074, (herein "*Rath '074*"). The Examiner asserts that *Rath '074* discloses claimed aspects of the invention. The Applicant respectfully traverses the rejection.

Rath '074 describes a process to form and use an aqueous etching solution containing sulfuric acid, hydrogen peroxide and hydrofluoric acid. *Rath '074* forms the

aqueous etching solution by admixing aqueous sulfuric acid with aqueous hydrogen peroxide and aqueous hydrofluoric acid and add “these solutions to water in an amount to provide the desired percentage.” (column 4, lines 8-16).

Therefore, *Rath* '074 does not teach, show or suggest a method for removing a residue from a substrate surface, comprising mixing an aqueous solution comprising sulfuric acid and hydrofluoric acid with a hydrogen peroxide solution to produce a cleaning solution, wherein the cleaning solution comprises hydrogen peroxide at a concentration within a range from about 1% to about 15% by weight, sulfuric acid at a concentration within a range from about 1% to about 10% by weight and hydrogen fluoride at a concentration within a range from about 10 ppm to about 1,000 ppm, applying an aliquot of the cleaning solution to a substrate surface for a time period and rinsing the aliquot from the substrate surface with water to form a wash solution, as recited in claim 1 and claims dependent thereon.

Also, *Rath* '074 does not teach, show or suggest a method for cleaning a residue from a substrate surface, comprising combining an aqueous solution and a hydrogen peroxide solution at a predetermined weight ratio of about 1 to about 20 to form a cleaning solution, exposing the substrate surface to an aliquot of the cleaning solution, wherein the cleaning solution comprises hydrogen peroxide at a concentration within a range from about 1% to about 15% by weight, sulfuric acid at a concentration within a range from about 1% to about 10% by weight, and hydrogen fluoride at a concentration within a range from about 10 ppm to about 1,000 ppm, and rinsing the substrate surface with water to remove a residue and the aliquot of the cleaning solution, as recited in claim 14 and claims dependent thereon.

Also, *Rath* '074 does not teach, show or suggest a method for mixing and delivering a cleaning solution to remove a residue from a substrate surface, comprising providing an aqueous solution comprising sulfuric acid and hydrofluoric acid, combining the aqueous solution and a hydrogen peroxide solution to form the cleaning solution, wherein the cleaning solution comprises hydrogen peroxide at a concentration within a range from about 1% to about 15% by weight, sulfuric acid at a concentration within a range from about 1% to about 10% by weight, hydrogen fluoride at a concentration within a range from about 10 ppm to about 1,000 ppm, and a surfactant at a

concentration of about 1,000 ppm or less, delivering the cleaning solution to a substrate surface, removing at least a portion of a residue from the substrate surface, and rinsing the substrate surface to remove the cleaning solution, as recited in claim 29 and claims dependent thereon.

Withdrawal of the rejection is respectfully requested.

Claims 1-2, 5, 9-12, 14, 16, 20, 24-27, 29-30, 34-35 and 37 stand rejected under 35 USC § 102(b) as being anticipated by Rath et al., EP-0918081, (herein "*Rath '081*"). The Examiner asserts that *Rath '081* discloses claimed aspects of the invention. The Applicant respectfully traverses the rejection.

Rath '081 describes a process to form and use an aqueous etching solution containing sulfuric acid, hydrogen peroxide and hydrofluoric acid. *Rath '081* forms the aqueous etching solution by admixing aqueous sulfuric acid with aqueous hydrogen peroxide and aqueous hydrofluoric acid and add "these solutions to water in an amount to provide the desired percentage." (page 3, paragraph 17).

Therefore, *Rath '081* does not teach, show or suggest a method for removing a residue from a substrate surface, comprising mixing an aqueous solution comprising sulfuric acid and hydrofluoric acid with a hydrogen peroxide solution to produce a cleaning solution, wherein the cleaning solution comprises hydrogen peroxide at a concentration within a range from about 1% to about 15% by weight, sulfuric acid at a concentration within a range from about 1% to about 10% by weight and hydrogen fluoride at a concentration within a range from about 10 ppm to about 1,000 ppm, applying an aliquot of the cleaning solution to a substrate surface for a time period and rinsing the aliquot from the substrate surface with water to form a wash solution, as recited in claim 1 and claims dependent thereon.

Also, *Rath '081* does not teach, show or suggest a method for cleaning a residue from a substrate surface, comprising combining an aqueous solution and a hydrogen peroxide solution at a predetermined weight ratio of about 1 to about 20 to form a cleaning solution, exposing the substrate surface to an aliquot of the cleaning solution, wherein the cleaning solution comprises hydrogen peroxide at a concentration within a range from about 1% to about 15% by weight, sulfuric acid at a concentration within a range from about 1% to about 10% by weight, and hydrogen fluoride at a concentration

within a range from about 10 ppm to about 1,000 ppm, and rinsing the substrate surface with water to remove a residue and the aliquot of the cleaning solution, as recited in claim 14 and claims dependent thereon.

Also, *Rath '081* does not teach, show or suggest a method for mixing and delivering a cleaning solution to remove a residue from a substrate surface, comprising providing an aqueous solution comprising sulfuric acid and hydrofluoric acid, combining the aqueous solution and a hydrogen peroxide solution to form the cleaning solution, wherein the cleaning solution comprises hydrogen peroxide at a concentration within a range from about 1% to about 15% by weight, sulfuric acid at a concentration within a range from about 1% to about 10% by weight, hydrogen fluoride at a concentration within a range from about 10 ppm to about 1,000 ppm, and a surfactant at a concentration of about 1,000 ppm or less, delivering the cleaning solution to a substrate surface, removing at least a portion of a residue from the substrate surface, and rinsing the substrate surface to remove the cleaning solution, as recited in claim 29 and claims dependent thereon.

Withdrawal of the rejection is respectfully requested.

Claims 1-2, 5, 9-10, 14, 16, 20, 24-25, 29-30, 34 and 37 stand rejected under 35 USC § 103(a) as being unpatentable over Kuhn-Kuhnenfeld et al., US 4,100,014, (herein "*Kuhn*"). The Examiner asserts that *Kuhn* discloses claimed aspects of the invention. The Applicant respectfully traverses the rejection.

Kuhn describes a process to remove a residue with an aqueous solution containing sulfuric acid, hydrogen peroxide and hydrofluoric acid. *Kuhn* forms the aqueous solution by mixing hydrogen peroxide and hydrofluoric acid and subsequently slow stirring concentrated sulfuric acid into the mixture. (column 1, lines 48-53).

Therefore, *Kuhn* does not teach, show or suggest a method for removing a residue from a substrate surface, comprising mixing an aqueous solution comprising sulfuric acid and hydrofluoric acid with a hydrogen peroxide solution to produce a cleaning solution, wherein the cleaning solution comprises hydrogen peroxide at a concentration within a range from about 1% to about 15% by weight, sulfuric acid at a concentration within a range from about 1% to about 10% by weight and hydrogen fluoride at a concentration within a range from about 10 ppm to about 1,000 ppm,

applying an aliquot of the cleaning solution to a substrate surface for a time period and rinsing the aliquot from the substrate surface with water to form a wash solution, as recited in claim 1 and claims dependent thereon.

Also, *Kuhn* does not teach, show or suggest a method for cleaning a residue from a substrate surface, comprising combining an aqueous solution and a hydrogen peroxide solution at a predetermined weight ratio of about 1 to about 20 to form a cleaning solution, exposing the substrate surface to an aliquot of the cleaning solution, wherein the cleaning solution comprises hydrogen peroxide at a concentration within a range from about 1% to about 15% by weight, sulfuric acid at a concentration within a range from about 1% to about 10% by weight, and hydrogen fluoride at a concentration within a range from about 10 ppm to about 1,000 ppm, and rinsing the substrate surface with water to remove a residue and the aliquot of the cleaning solution, as recited in claim 14 and claims dependent thereon.

Also, *Kuhn* does not teach, show or suggest a method for mixing and delivering a cleaning solution to remove a residue from a substrate surface, comprising providing an aqueous solution comprising sulfuric acid and hydrofluoric acid, combining the aqueous solution and a hydrogen peroxide solution to form the cleaning solution, wherein the cleaning solution comprises hydrogen peroxide at a concentration within a range from about 1% to about 15% by weight, sulfuric acid at a concentration within a range from about 1% to about 10% by weight, hydrogen fluoride at a concentration within a range from about 10 ppm to about 1,000 ppm, and a surfactant at a concentration of about 1,000 ppm or less, delivering the cleaning solution to a substrate surface, removing at least a portion of a residue from the substrate surface, and rinsing the substrate surface to remove the cleaning solution, as recited in claim 29 and claims dependent thereon.

Withdrawal of the rejection is respectfully requested.

Claims 3-4 and 17-19 stand rejected under 35 USC § 103(a) as being unpatentable over *Ramachandran*, *Rath '074*, *Rath '081* or *Kuhn* in view of *Gotoh et al.*, US 5,650,041, (herein "*Gotoh*"). The Examiner concedes that *Ramachandran*, *Rath '074*, *Rath '081* and *Kuhn* each fail to describe the use of a surfactant within the cleaning solution. The Examiner asserts that since *Gotoh* discloses a cleaning solution containing hydrofluoric acid and a surfactant, it would have been obvious at the time of

the invention to include a surfactant with the cleaning solutions of *Ramanchandran, Rath '074, Rath '081 or Kuhn*. The Applicant respectfully traverses the rejection.

Ramanchandran, Rath '074, Rath '081 and Kuhn have each been distinguished above. *Gotoh* discloses the use of a surfactant within a hydrofluoric acid solution, but remains silent to most other elements of the claimed invention.

Therefore, *Gotoh and Ramanchandran, Rath '074, Rath '081 or Kuhn*, alone or in combination, does not teach, show or suggest a method for removing a residue from a substrate surface, comprising mixing an aqueous solution comprising sulfuric acid and hydrofluoric acid with a hydrogen peroxide solution to produce a cleaning solution, wherein the cleaning solution comprises hydrogen peroxide at a concentration within a range from about 1% to about 15% by weight, sulfuric acid at a concentration within a range from about 1% to about 10% by weight and hydrogen fluoride at a concentration within a range from about 10 ppm to about 1,000 ppm, applying an aliquot of the cleaning solution to a substrate surface for a time period and rinsing the aliquot from the substrate surface with water to form a wash solution, as recited in claim 1 and claims 3 and 4 dependent thereon.

Also, *Gotoh and Ramanchandran, Rath '074, Rath '081 or Kuhn*, alone or in combination, does not teach, show or suggest a method for cleaning a residue from a substrate surface, comprising combining an aqueous solution and a hydrogen peroxide solution at a predetermined weight ratio of about 1 to about 20 to form a cleaning solution, exposing the substrate surface to an aliquot of the cleaning solution, wherein the cleaning solution comprises hydrogen peroxide at a concentration within a range from about 1% to about 15% by weight, sulfuric acid at a concentration within a range from about 1% to about 10% by weight, and hydrogen fluoride at a concentration within a range from about 10 ppm to about 1,000 ppm, and rinsing the substrate surface with water to remove a residue and the aliquot of the cleaning solution, as recited in claim 14 and claims 17-19 dependent thereon.

Withdrawal of the rejection is respectfully requested.

Claims 13, 28 and 36 stand rejected under 35 USC § 103(a) as being unpatentable over *Ramanchandran, Rath '074, Rath '081 or Kuhn* in view of *Oonishi et al.*, US 6,273,959, (herein "*Oonishi*"). The Examiner concedes that *Ramanchandran,*

Rath '074, Rath '081 and Kuhn each fail to describe the use of sonication. The Examiner asserts that since *Oonishi* describes a method to clean a semiconductor device with sonication and a cleaning solution, it would have been obvious at the time of the invention to include sonication with the cleaning solutions of *Ramanchandran, Rath '074, Rath '081 or Kuhn*. The Applicant respectfully traverses the rejection.

Ramanchandran, Rath '074, Rath '081 and Kuhn have each been distinguished above. *Oonishi* discloses the use of sonication with a cleaning solution. However, *Oonishi* discloses a single cleaning solution that is prepared by blending sulfuric acid, hydrogen peroxide, hydrogen fluoride, a sulfonic acid and water. (column 4, lines 10-15).

Therefore, *Oonishi and Ramanchandran, Rath '074, Rath '081 or Kuhn*, alone or in combination, does not teach, show or suggest a method for removing a residue from a substrate surface, comprising mixing an aqueous solution comprising sulfuric acid and hydrofluoric acid with a hydrogen peroxide solution to produce a cleaning solution, wherein the cleaning solution comprises hydrogen peroxide at a concentration within a range from about 1% to about 15% by weight, sulfuric acid at a concentration within a range from about 1% to about 10% by weight and hydrogen fluoride at a concentration within a range from about 10 ppm to about 1,000 ppm, applying an aliquot of the cleaning solution to a substrate surface for a time period and rinsing the aliquot from the substrate surface with water to form a wash solution, as recited in claim 1 and claim 13 dependent thereon.

Also, *Oonishi and Ramanchandran, Rath '074, Rath '081 or Kuhn*, alone or in combination, does not teach, show or suggest a method for cleaning a residue from a substrate surface, comprising combining an aqueous solution and a hydrogen peroxide solution at a predetermined weight ratio of about 1 to about 20 to form a cleaning solution, exposing the substrate surface to an aliquot of the cleaning solution, wherein the cleaning solution comprises hydrogen peroxide at a concentration within a range from about 1% to about 15% by weight, sulfuric acid at a concentration within a range from about 1% to about 10% by weight, and hydrogen fluoride at a concentration within a range from about 10 ppm to about 1,000 ppm, and rinsing the substrate surface with

water to remove a residue and the aliquot of the cleaning solution, as recited in claim 14 and claim 28 dependent thereon.

Also, *Oonishi* and *Ramanchandran*, *Rath '074*, *Rath '081* or *Kuhn*, alone or in combination, does not teach, show or suggest a method for mixing and delivering a cleaning solution to remove a residue from a substrate surface, comprising providing an aqueous solution comprising sulfuric acid and hydrofluoric acid, combining the aqueous solution and a hydrogen peroxide solution to form the cleaning solution, wherein the cleaning solution comprises hydrogen peroxide at a concentration within a range from about 1% to about 15% by weight, sulfuric acid at a concentration within a range from about 1% to about 10% by weight, hydrogen fluoride at a concentration within a range from about 10 ppm to about 1,000 ppm, and a surfactant at a concentration of about 1,000 ppm or less, delivering the cleaning solution to a substrate surface, removing at least a portion of a residue from the substrate surface, and rinsing the substrate surface to remove the cleaning solution, as recited in claim 29 and claim 36 dependent thereon.

Withdrawal of the rejection is respectfully requested.

In conclusion, the references cited by the Examiner, alone or in combination, do not teach, show or suggest the invention as claimed.

The secondary references made of record including EP 0477504, US 5,294,570 and US 4,220,706 are noted. However, it is believed that the secondary references are no more pertinent to the Applicant's disclosure than the primary references cited in the office action. Therefore, the Applicant believes that a detailed discussion of the secondary references is not necessary for a full and complete response to this office action.

Having addressed all issues set out in the office action, the Applicant respectfully submits that the claims are in condition for allowance and respectfully request that the claims be allowed.

Respectfully submitted,



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